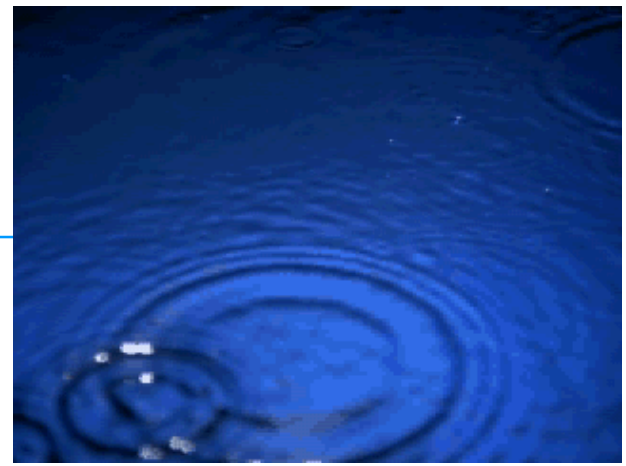
GPM

Global Precipitation Measurement

Microwave Instruments

May 30, 2001



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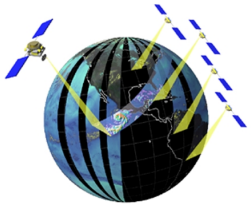
GPM Microwave Instruments Discussion Topics

- *Program Constraint*
- *Current Thinking on Instruments*
- *Calibration*
- *Current Plans/Draft Acquisition Schedule*
- *Feedback from Attendees*



GPM Microwave Instruments Program Constraint

Modest financial resources are available for instruments.

- *GPM described as a "Low Risk" program.*
  - *Technology used on TRMM provided acceptable results*
  - *There is limited need for new technology developments for GPM*
- *Minor modification of existing instrument designs will be pursued, where appropriate, to reduce non-recurring engineering expenses*
- *Multiple copies the same instrument design will be obtained, when possible, to minimize cost*
- *Cost to the GPM Program will be a significant consideration in all Program decisions*

GPM Microwave Instruments
Current Thoughts Regarding Instruments

Three Types of Instruments Under Consideration

- *Conical-scan microwave radiometer*

  Anticipate placing on both

  – *Core Spacecraft*

  – *Constellation Spacecraft*

- *Nadir-viewing microwave radiometer*

  Currently evaluating

  – *Benefits of its use on the Core Spacecraft*

  – *Alternative designs*

- *Narrow-beam, nadir-looking radar*

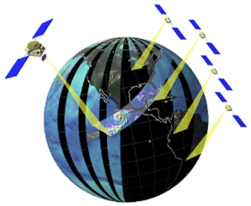
  Investigating the cost and benefit for use on the Constellation Spacecraft

GPM Microwave Instruments
Conical Scan Radiometer

The Science Community is very satisfied with the TRMM Microwave Imager (TMI). Its characteristics provide a reference point for defining instrument characteristics for GPM. Significant characteristics of TMI include:

- *Conical-scan which provides constant ground spatial resolution (spot size) and constant incident angle*
  - *36 km ground spatial resolution (IFOV-CT) at 10.65 GHz (from 350 km altitude)*
  - *Nadir half-cone angle of 49°*
- *Channel set*

  10.65, 19.35, 37.0, 85.5 GHz H&V Pol, and 21.3 V Pol



GPM Microwave Instruments
Conical Scan Radiometer
(Continued)

GPM Capabilities desired in addition to, or in lieu of, those provided by TMI

- *The addition of a 150 GHz H&V Pol channel to the TMI channel set*
- *Ground spatial resolution at least equivalent to that achieved by TMI at 350 km*
  - *Desired, as a minimum, for the Core spacecraft at 400 km*
  - *A goal for the Constellation spacecraft at ~600 km*
- *Who provides momentum compensation (spacecraft or by the instrument) is currently an open issue*
  - *Industry comments requested*

GPM Microwave Instruments
Conical Scan Radiometer
(Continued)

Modification of existing instrument design viewed as a cost-effective approach

- *Minimize expenditures on Non-Recurring Engineering*
- *Substantial production experience for conical-scan designs provide confidence in:*
  - *cost estimates*
  - *performance projections*
  - *reliability of hardware*
- *Relevant known examples include SSM/I, SSMIS, TMI, and possibly CMIS*

  Are there others?

GPM Microwave Instruments
Nadir-Viewing Radiometer on Core

Implementation is uncertain-

There currently is not a consensus among the Scientists regarding the importance, or characteristics, of this hardware.

Purpose-

To make simultaneous measurements of the same atmospheric volume with both a microwave radiometer and with the DPR at at a frequency common with the conical-scan radiometer

- *Correlation with the radar measurements will allow better scientific understanding of the radiometric measurements*
- *Expected to help resolve the difference in the bias in rain rate measurements made by TRMM using the TMI and the PR*

GPM Microwave Instruments
Nadir-Viewing Radiometer on Core
(continued)

Instrument concept is still undefined

- *Alternatives considered to-date include both a cross-track scanner, and an aperture with a fixed nadir alignment*
- *Likely to include a 37 GHz to match one of the conical-scan radiometer channels*
- *The same ground resolution as the DPR is desired (i.e. ~5 km at nadir at 35 GHz)*

GPM Microwave Instruments
Pencil Beam Radar on Constellation

Purpose is to provide information regarding the location of the freezing layer within the cloud. This helps to initialize the retrieval algorithms

- *Current interest in this instrument resides mostly within Europe*
- *Operating frequencies and radar characteristics have not been defined at this time*
- *GPM is currently interested in identifying what the capabilities and experiences are in industry*

GPM Microwave Instruments
Dual Frequency Precipitation Radar

The Dual Frequency Precipitation Radar (DPR) will be provided to NASA by NASDA in a similar fashion as the Precipitation Radar was provided for the TRMM Program

Characteristics of the current concept for the instrument include:

- *Ku- and Ka-band radar units are independent instruments*
- *Size: Ku-band: 2.4x2.4x0.5 m/ Ka-band: 1.0x1.0x0.5 m*
- *Matched beams for Ka- and Ku-bands*
- *Antenna type: Slotted wave-guide*
- *Scan: Active Phased array*
- *Operating frequencies: 13.6 & 35.55 GHz*
- *Swath width: 245 km (Ku-band) & 100-245 km (Ka-band)*
- *Range resolution: 250 m (Ku-band) & 250/500 m (Ka-band)*
- *Horizontal resolution: 5 km for both Ku- and Ka-bands*

GPM Microwave Instruments Calibration

Microwave radiometers are expected to be self-calibrating from stabilized hot and cold loads

GPM plans to have several ground "super sites" which will allow calibration and validation of the DPR and the microwave radiometer retrieval algorithms

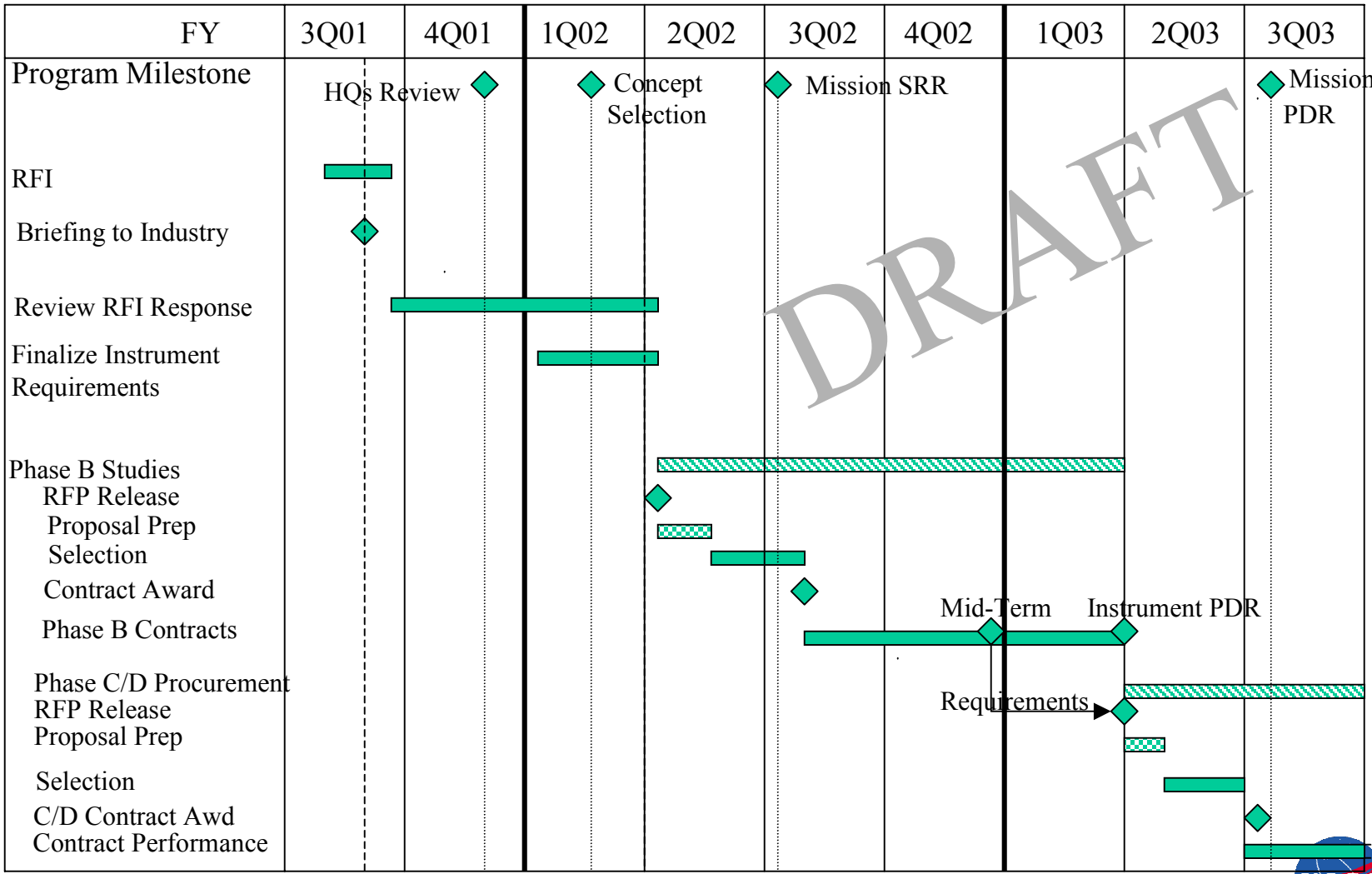
Measurements from the DPR and Core radiometer will also provide a means of establishing a ground processing calibration reference between the Core spacecraft and other GPM spacecraft during orbital crossings

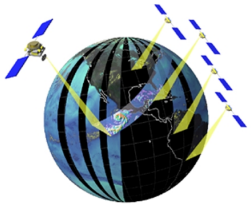
GPM Instruments
Current Plans for Acquisition

Key Dates

- *Request for Information*
  - *Released May 8, 2001*
  - *Responses due June 22, 2001*
- *Multiple Phase B Studies*
  - *RFP Release Jan 2002*
  - *Contract Award April 2002*
  - *Contract period of performance concludes with PDR in Jan 2003*
- *Phase C/D Procurement*
  - *RFP Release Jan 2003*
  - *Contract Award April 2003*
  - *Instrument Delivery October 2005?*

Conical Scan Radiometer Development Schedule





GPM Instruments Briefing to Industry

Presentation material will be available soon on the GPM home page: http://gpm.gsfc.nasa.gov

Feedback/Questions from Industry-

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